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COAL RESOURCE OCCURRENCE MAPS AND COAL DEVELOPMENT POTENTIAL MAPS OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO, AND LA PLATA COUNTY, COLORADO

[Report includes 23 plates]

by

Dames & Moore

This report has not been edited for conformity with U.S. Geological Survey editorial standards or stratigraphic nomenclature.

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ADOBE DOWNS RANCH 7 1/2-MINUTE QUADRANGLE

INTRODUCTION

Purpose

This text is to be used in conjunction with the Coal Resource Occurrence (CRO) Maps and Coal Development Potential (CDP) Map of the Adobe Downs Ranch quadrangle, San Juan County, New Mexico, and La Plata County, Colorado. These maps were compiled to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) of the western United States. The work was performed under contract with the Conservation Division of the U.S. Geological Survey (Contract No. 14-08-0001-17172).

The resource information gathered in this program is in response to the Federal Coal Leasing Amendments Act of 1976 and is a part of the U.S. Geological Survey's coal program. The information provides basic data on coal resources for land-use planning purposes by the Bureau of Land Management, state and local governments, and the public.

Location

The Adobe Downs Ranch 7 1/2-minute quadrangle is located in northern San Juan County, New Mexico, and southern La Plata County, Colorado. The area is approximately 14 miles (23 km) northeast of Farmington, New Mexico.

Accessibility

The Adobe Downs Ranch quadrangle is accessible from New Mexico State Route 550 to the east, southeast, and south of the area. A light-duty road, State Route 173, extends northward into the area from State Route 550. Numerous unimproved dirt roads intersecting State Route 173 provide access to remote parts of the area. The Atchison, Topeka, and Santa Fe Railway operates a route 103 miles (166 km) south of the area at Gallup, New Mexico.

Physiography

This quadrangle is in the northwestern portion of the Central Basin area (Kelley, 1950) of the structural depression known as the San Juan Basin. Elevations range from 5,860 ft (1,786 m) in Hartley Wash to 6,940 ft (2,115 m) in the northeast. The major drainage of the area is Farmington Glade Arroyo, which drains to the southwest through the center of the quadrangle. Several other washes and arroyos drain the areas at the perimeter of the quadrangle. The drainage areas of these arroyos have low relief; however, higher relief is common along the divides between arroyos. In particular, steep-walled canyons have been cut by washes in the eastern part of the area.

Climate

The climate of the San Juan Basin is arid to semi-arid. Annual precipitation is usually less than about 10 inches (25 cm) with slight vari-

ations across the basin due to elevational differences. Rainfall is rare in the early summer and winter; most precipitation is received in July and August as afternoon thundershowers. Annual temperatures range from below 0°F (-18°C) to over 100°F (38°C) in the basin. Snowfall may occur from November to April.

Land Status

Approximately 82 percent of the quadrangle is within the northwestern part of the San Juan Basin Known Recoverable Coal Resource Area. The Federal Government owns the coal rights for approximately 74 percent of the KRCRA land within the quadrangle as shown on Plate 2 of the Coal Resource Occurrence Maps. Coal lease (NM 0315559) covers approximately 1 percent of the quadrangle.

GENERAL GEOLOGY

Previous Work

Reeside (1924) mapped the surficial geology of the area on a scale of 1:250,000 as part of a study of the Upper Cretaceous and Tertiary formations of the San Juan Basin. More recently, Fassett and Hinds (1971) made subsurface interpretations of Fruitland Formation coal occurrences as part of a larger San Juan Basin coal study.

Geologic History

The San Juan Basin, an area of classic transgressive and regressive sedimentation, provided the ideal environment for formation of coals during Late Cretaceous time. At that time a shallow epeiric sea, which trended northwest-southeast, was northeast of the basin. The sea transgressed southwesterly into the basin area and regressed northeasterly numerous times; consequently, sediments from varying environments were deposited across the basin. Noncarbonaceous terrestrial deposition predominated during Paleocene and Eocene time.

Depositional evidence of the final retreat of the Late Cretaceous sea is the nearshore regressive Pictured Cliffs Sandstone. Southwest (shoreward) of the beach deposits, swamps, which were dissected by streams, accumulated organic matter which later became coals of the Fruitland Formation. Deposition of organic material was influenced by the strandline as shown by both the continuity of the coal beds parallel to the north-south strandline in this part of the basin and their discontinuity perpendicular to it to the east. The less continuous Fruitland coals appear to be noncorrelative, but are stratigraphically equivalent in terms of their relative position within the Fruitland Formation.

The brackish-water swamp environment of the Fruitland moved farther to the northeast as the regression continued in that direction. Terrestrial freshwater sediments then covered the quadrangle as indicated by the lacustrine, channel, and floodplain deposits of the Kirtland Shale. This sequence of events is evidenced by both an upward decrease in occurrence and thickness of Fruitland coals and a gradational change to noncarbonaceous deposits of

the Kirtland. Continuous deposition during Late Cretaceous time ended with the Kirtland. The sea then retreated beyond the limits of the quadrangle area, and modern basin structure began to develop. An erosional unconformity developed in a relatively short time as part of the Cretaceous Kirtland Shale was removed.

Terrestrial deposition resumed in the Paleocene as represented by the Ojo Alamo Sandstone and the overlying Nacimiento Formation. Alluvial plain and floodplain deposits of the Ojo Alamo were followed by the thick, lithologically varied deposits of the Nacimiento during continuous nonmarine deposition. The Nacimiento was later exposed to erosion.

The Eocene San Jose Formation was subsequently deposited over the Nacimiento erosional surface, reflecting various nonmarine environments which developed across the basin. Deposition and structural deformation of the basin then ceased, and the warped strata of the San Juan Basin have been exposed to erosional processes to the present time.

Stratigraphy

The formations studied in this quadrangle range from Late Cretaceous to Eocene in age. They are, in order from oldest to youngest: the Pictured Cliffs Sandstone, Fruitland Formation, Kirtland Shale, Ojo Alamo Sandstone, Nacimiento Formation, and San Jose Formation. A composite columnar section on CRO Plate 3 illustrates the stratigraphic relationships of these formations and is accompanied by lithologic descriptions of the individual formations.

The Pictured Cliffs Sandstone averages 150 ft (46 m) thick. Because the unit is present throughout most of the San Juan Basin and easily recognized on geophysical logs, the top was picked as the datum (CRO Plate 3) for Fruitland coal correlations. The formation consists of a gray, fine-grained, micaceous, glauconitic, calcareous sandstone interbedded with gray to green shale near the base of the unit. Intertonguing with the overlying Fruitland Formation occurs throughout the entire basin, and, consequently, minor Fruitland coal beds commonly are present in the upper portion of the Pictured Cliffs.

The major coal-bearing unit in the quadrangle is the Fruitland Formation. Wide variations in reported thickness of the Fruitland are common due to an indistinct upper contact with the Kirtland Shale, but the average is about 450 ft (137 m) in this quadrangle. Many authors have utilized various criteria for establishing the upper contact, but, in general, for this study the uppermost coal in the Fruitland was chosen (after Fassett and Hinds, 1971). The formation consists primarily of gray, carbonaceous shale, interbedded buff to gray to brown, calcareous, slightly glauconitic sandstone, and lenticular coal beds.

The Upper Cretaceous Kirtland Shale conformably overlies the Fruitland Formation and averages 1,200 ft (366 m) in thickness in this area. It consists predominantly of gray to gray-green shale with sandy stringers, thin interbedded white to gray, fine-grained, micaceous sandstone, and minor beds of various lithologies between shale and sandstone. The formation has previously been divided into several members by various authors; however, for the purposes of this report it was not necessary to distinguish between the individual members.

The Ojo Alamo Sandstone conformably overlies the Kirtland Shale. It is gray, medium- to very coarse-grained, locally conglomeratic, micaceous sandstone, and averages 75 ft (23 m) in thickness.

Approximately 1,100 to 1,200 ft (335-366 m) of the Paleocene Nacimiento Formation overlie the Ojo Alamo Sandstone. These rocks consist of white to buff to gray, fine- to coarse-grained, micaceous, locally calcareous sandstone, and interbedded gray to gray-green, micaceous, silty shale.

The San Jose Formation of Eocene age unconformably overlies the Nacimiento Formation. It predominantly consists of buff to brown, coarse-grained to conglomeratic sandstone with abundant volcanic grains, brown to gray shale, and many lithologies gradational between the two.

A total of four formations crop out within the quadrangle. The outcrop pattern trends in a northeast-southwest direction, with the formations becoming successively younger to the southeast. The oldest formation exposed is the Kirtland Shale which crops out along the flank of the Hogback Monocline in the northwestern corner of the area. The entire sections of the Ojo Alamo Sandstone and the Nacimiento Formation are present and crop out consecutively across the quadrangle in an easterly and southeasterly direction. The lowermost beds of the San Jose Formation, the youngest formation in the area, are exposed in the northeastern corner of the quadrangle.

Structure

The Adobe Downs Ranch quadrangle is located in the Central Basin area (Kelley, 1950) of the major structural depression known as the San Juan Basin. The axis of the basin extends across the southeastern edge of the

quadrangle area and trends in an arcuate pattern across the northern portion of the Central Basin area (Baltz, 1967). A structural feature known as the Hogback Monocline trends across the northwestern edge of the area in a northeast-southwest direction. Reeside (1924) measured dips in the Hogback Monocline area of 8° to 16° to the southeast. The dip angle decreases to the southeast where Reeside measured dips of 1° to 2°.

COAL GEOLOGY

Five coal beds (Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, Fruitland 5) and a coal zone (Fruitland) were identiifed in the subsurface of this quadrangle (CRO Plate 1). The Fruitland 1 (Fr 1) coal bed is defined by the authors as the lowermost coal of the Fruitland Formation; it is generally directly above the Pictured Cliffs Sandstone. The Fruitland 2 (Fr 2) coal bed is above the Fruitland 1; they are separated by a rock interval of 19 to 73 ft (5.8-22.3 m). The Fruitland 3 (Fr 3) coal bed is above the Fruitland 2 separated by a rock interval of 23 to 100 ft (7.0-30.5 m); the Fruitland 4 (Fr 4) coal bed is above the Fruitland 3 separated by a rock interval of 28 to 90 ft (8.5-27.4 m); the Fruitland 5 (Fr 5) coal bed is above the Fruitland 4 separated by a rock interval averaging 42 ft (12.8 m). Local (L) coals which are discontinuous and noncorrelative occur between these Fruitland coal beds. Although these coal beds have been correlated and mapped as consistent horizons, they may actually be several different coal beds that are litho-stratigraphically equivalent but not laterally continuous.

The remaining coals in the upper portion of the Fruitland Formation are designated as Fruitland zone (Fr zone) coals. These coals are generally

noncorrelative, discontinuous, and less than reserve base thickness (5 ft [1.5 m]); an exception is a 5-ft (1.5-m) coal in drill hole 21 (CRO Plate 3). As a result of these characteristics, derivative maps were not constructed.

Fruitland Formation coals in the northwestern part of the San Juan Basin are considered high volatile B to high volatile A bituminous in rank. The rank has been determined on a moist, mineral-matter-free basis with calorific values averaging 14,196 Btu's per pound (33,020 kj/kg) (Amer. Soc. for Testing and Materials, 1977). The coal is hard, brittle, and black with a bright luster. The coal readily slakes with exposure to weather; however, it stocks fairly well when protected. The "as received" analyses indicate moisture content varying from 1.7 to 6.9 percent, ash content ranging from 8.4 to 16.2 percent, sulfur content varying from 0.5 to 1.32 percent, and heating values on the order of 11,490 to 13,350 Btu's per pound (26,726-31,052 kj/kg). Analyses of several Fruitland Formation coals are given in Table 1 (Bauer and Reeside, 1921; Fassett and Hinds, 1971; Hayes and Zapp, 1955).

Fruitland 1 Coal Bed

The coal bed has been mapped only in areas of less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 5), the coal bed dips less than 1° to the east, except in the extreme northwest corner where the dip is approximately 14° to the southeast. As a result of topography and dip, overburden (CRO Plate 6) varies from less than 200 ft (61 m) in the extreme northwest corner to greater than 3,000 ft (914 m) in the northeast. The isopach map (CRO Plate

TABLE 1

Analyses of coal samples from the Fruitland Formation

(Form of analysis: A, as received; B, moisture free; C, moisture and ash free)

U.S. Bureau Mines Lab No.	Well or Other Source	Location			Approx. Depth Interval of Sample (ft.)	Form of Analysis	Proximate, percent					Heating Value (Btu)	Remarks
		Section	T.N.	R.W.			Moisture	Volatile matter	Fixed Carbon	Ash	Sulfur		
M-15777	El Paso Nat Gas Case No. 9	SW¼ 8	31	11	2,710-2,740	A	1.7	40.3	47.0	11.0	0.7	13,350	
						B	—	41.0	47.9	11.1	0.7	13,580	
						C	—	46.1	53.9	—	0.8	13,280	
M-19884	Consolidated Oil & Gas Mitchell No. 1-5	SW¼ 5	31	12	2,215-3,000	A	2.4	39.4	47.3	10.9	0.5	13,090	
						B	—	40.4	48.5	11.1	0.5	13,410	
						C	—	45.5	54.5	—	0.6	15,100	
M-15141	Consolidated Oil & Gas Freeman No. 1-11	NE¼ 11	31	13	1,776-1,782	A	2.3	37.9	43.6	16.2	1.3	12,040	
						B	—	38.8	44.7	16.5	1.3	12,320	
						C	—	46.5	53.5	—	1.6	14,760	
17749	New Mexico Mine	7	32	12	————	A	6.6	35.4	44.9	13.1	0.66	11,490	
						B	—	37.9	48.0	14.1	0.71	12,300	
						C	—	44.1	55.9	—	0.83	14,310	
M-61247	Morgan Mine (tipple)	15	32	13	————	A	5.4	38.6	46.0	10.0	—	12,320	
						B	—	40.9	48.6	10.5	—	13,030	
						C	—	45.7	54.3	—	—	14,360	
M-61248	W.H. Thomas Mine (tipple)	15	32	13	————	A	5.4	40.0	46.2	8.4	—	12,650	
						B	—	42.2	48.9	8.9	—	13,380	
						C	—	46.4	53.6	—	—	14,680	
29249	W.H. Thomas Mine (500 ft from entry)	22	32	13	————	A	5.9	39.1	44.0	11.0	0.63	12,050	
						B	—	41.5	46.8	11.7	0.67	12,810	
						C	—	47.0	53.0	—	0.76	14,510	
29250	Jones Mine (500 ft from entry)	SE¼ 21	32	13	————	A	6.9	38.1	43.1	11.9	1.32	11,630	
						B	—	41.0	46.2	12.8	1.42	12,490	
						C	—	47.0	53.0	—	1.63	14,330	

To convert Btu's/lb to kj/kg, multiply Btu's/lb by 2.326.
To convert feet to meters, multiply feet by 0.3048.

4) shows the coal bed is greater than 20 ft (6.1 m) thick in the northwest and a part of the southeast. The thickness decreases in all directions, and the coal is absent in small areas in the center and the southwest corner of the quadrangle.

Chemical Analyses of the Fruitland 1 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Bauer and Reeside, 1921; Fassett and Hinds, 1971; Hayes and Zapp, 1955).

Fruitland 2 Coal Bed

The coal bed has been mapped only in areas with less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 9), the coal bed dips less than 1° to the east, except in the extreme northwest corner where the dip is nearly 14° to the southeast. As a result of topography and dip, overburden (CRO Plate 10) varies from less than 200 ft (61 m) in the extreme northwest corner to greater than 3,000 ft (914 m) in the northeast. The isopach map (CRO Plate 8) shows that the coal bed has a thickness of greater than 5 ft (1.5 m) in an area extending from the northeast to the west-central parts of the quadrangle. The thickness decreases in all directions from these areas, and the coal is absent in several areas throughout the quadrangle.

Chemical Analyses of the Fruitland 2 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Bauer and Reeside, 1921; Fassett and Hinds, 1971; Hayes and Zapp, 1955).

Fruitland 3 Coal Bed

The coal bed has been mapped only in areas with less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 13), the coal bed dips less than 1° to the east, except in the extreme northwest corner where it dips approximately 14° to the southeast. As a result of topography and dip, overburden varies from less than 1,200 ft (366 m) in the northwest part of the mapped area to greater than 3,000 ft (914 m) in the northeast. The isopach map (CRO Plate 12) illustrates that the coal bed is greater than 5 ft (1.5 m) thick in the north and in a portion of the south. The coal is absent in the north and several locations in the south.

Chemical Analyses of the Fruitland 3 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Bauer and Reeside, 1921; Fassett and Hinds, 1971; Hayes and Zapp, 1955).

Fruitland 4 Coal Bed

The coal bed has been mapped only in areas with less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 17), the coal bed dips less than 1° to the east, except in the northwest corner where the dip is approximately 14° to the southeast. As a result of topography and dip, overburden varies from less than 200 ft (61 m) in the northwest corner to greater than 3,000 ft (914 m) in the northeast. The isopach map (CRO Plate 16) shows the coal bed has a thickness

of greater than 10 ft (3.0 m) in the northeast and the thickness decreases away from this area. The coal is absent in several areas throughout the quadrangle.

Chemical Analyses of the Fruitland 4 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Bauer and Reeside, 1921; Fassett and Hinds, 1971; Hayes and Zapp, 1955).

Fruitland 5 Coal Bed

As indicated by the structure contour map (CRO Plate 21), the coal bed dips less than 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 22) varies from less than 2,400 ft (732 m) in the south to greater than 2,800 ft (853 m) in the northeast part of the mapped area. The isopach map (CRO Plate 20) illustrates that the coal bed has a thickness of greater than 5 ft (1.5 m) in the central part of the southeast. The thickness decreases from this area. The coal is present only in the southeast part of the quadrangle.

Chemical Analyses of the Fruitland 5 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Bauer and Reeside, 1921; Fassett and Hinds, 1971; Hayes and Zapp, 1955).

COAL RESOURCES

Coal resource data from oil and gas wells and pertinent publications were utilized in the construction of isopach and structure contour maps of coals in this quadrangle. All of the coals studied within Federal lands in the Adobe Downs Ranch quadrangle are more than 200 ft (61 m) below the ground surface and, thus, have no outcrop or surface development potential.

The U.S. Geological Survey designated the Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, and Fruitland 5 coal beds for the determination of coal resources in this quadrangle. Coals of the Fruitland zone were not evaluated because they are discontinuous, limited in extent, and generally less than the reserve base thickness (5 ft [1.5 m]).

For Reserve Base and Reserve calculations, each coal bed was areally divided into measured, indicated, and inferred resource categories (CRO Plates 7, 11, 15, and 19) according to criteria established in U.S. Geological Survey Bulletin 1450-B. Data for calculation of Reserve Base and Reserves for each category were obtained from the respective coal isopach (CRO Plates 4, 8, 12, 16, and 20) and areal distribution maps (CRO Plates 7, 11, 15, and 19) for each coal bed. The surface area of each isopached bed was measured by planimeter, in acres, for each category, then multiplied by both the average isopached thickness of the coal bed and 1,800 short tons of coal per acre-foot (13,239 tons/hectare-meter), the conversion factor for bituminous coal. This yields the Reserve Base coal, in short tons, for each coal bed.

In order to calculate Reserves, a recovery factor of 50 percent was applied to the Reserve Base tonnages for underground coal. However, in areas

of underground coal exceeding 12 ft (3.7 m) in thickness, the Reserves (mineable coal) were calculated on the basis of a maximum coal bed thickness of 12 ft (3.7 m), which represents the maximum economically mineable thickness for a single coal bed in this area by current underground mining technology.

Reserve Base and Reserve values for measured, indicated, and inferred categories of coal for the Fruitland 1, Fruitland 2, Fruitland 3, and Fruitland 4 and Fruitland 5 beds are shown on CRO Plates 7, 11, 15, and 19, respectively, and are rounded to the nearest hundredth of a million short tons. The total coal Reserve Base, by section, is shown on CRO Plate 2 and totals approximately 401 million short tons (364 million metric tons).

The coal development potential for each bed was calculated in a manner similar to the Reserve Base, from planimetered measurements, in acres, for areas of high, moderate, and low potential for subsurface mining methods. The Adobe Downs Ranch quadrangle has development potential for subsurface mining methods only (CDP Plate 23).

COAL DEVELOPMENT POTENTIAL

Coal beds of 5 ft (1.5 m) or more in thickness which are overlain by 200 to 3,000 ft (61-914 m) of overburden are considered to have potential for underground mining and are designated as having high, moderate, or low development potential according to the overburden thickness: 200 to 1,000 ft (61-305 m), high; 1,000 to 2,000 ft (305-610 m), moderate; and 2,000 to 3,000 ft (610-914 m), low. Table 2 summarizes the coal development potential, in short tons, for underground coal of the Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, and Fruitland 5 coal beds.

TABLE 2

COAL RESOURCE DATA FOR UNDERGROUND MINING METHODS FOR FEDERAL COAL LANDS
(in short tons) IN THE ADOBE DOWNS RANCH QUADRANGLE,
SAN JUAN COUNTY, NEW MEXICO, AND LA PLATA COUNTY, COLORADO

(To convert short tons to metric tons, multiply by 0.9072)

Coal Bed	High Development Potential	Moderate Development Potential	Low Development Potential	Total
Fruitland 5	—	—	19,500,000	19,500,000
Fruitland 4	—	790,000	14,810,000	15,600,000
Fruitland 3	—	—	48,420,000	48,420,000
Fruitland 2	—	—	49,630,000	49,630,000
Fruitland 1	--	34,000,000	233,900,000	267,900,000
TOTAL	—	34,790,000	366,260,000	401,050,000

Development Potential for Surface Mining Methods

All coals studied within Federal lands in the Adobe Downs Ranch quadrangle occur more than 200 ft (61 m) below the ground surface and, thus, they have no coal development potential for surface mining methods.

Development Potential for Subsurface Mining Methods

Underground coal of the Fruitland 1 and Fruitland 4 coal beds has moderate development potential in the northwest corner of the quadrangle (CDP Plate 23) where coal bed thicknesses are approximately 20 to 25 ft (6.1-7.6 m) for the Fruitland 1 (CRO Plate 4) and 5 ft (1.5 m) for the Fruitland 4 (CRO Plate 16), and the overburden thicknesses range from 1,000 to 2,000 ft (305-610 m) for the Fruitland 1 (CRO Plate 6) and 1,600 to 1,800 ft (488-549 m) for the Fruitland 4 (CRO Plate 18).

The five Fruitland coal beds in this quadrangle for which derivative maps were constructed have low coal development potential. The Fruitland 1 coal with low potential for development is in the northwest quadrant and the southern half of the quadrangle, where the coal is 5 to 20 ft (1.5-6.2 m) thick (CRO Plate 4), and the overburden thickness increases from 2,400 ft (732 m) in the west to 3,000 ft (914 m) in the east (CRO Plate 6). Low potential coal of the Fruitland 2 occurs in the north-northwest and in the west-central part of the area. The coal is 5 to 8 ft (1.5-2.4 m) thick (CRO Plate 8), and the overburden thickness ranges from 2,200 ft (671 m) in the west to 3,000 ft (914 m) in the north (CRO Plate 10). The Fruitland 3 coal bed has low development potential in the north-central, east-central,

and south-central areas (as shown on the areal distribution map [CRO Plate 15]), where the coal bed thickness varies from 5 to 8 ft (1.5-2.4 m) (CRO Plate 12), and the overburden ranges from 2,400 to 3,000 ft (732-914 m) thick (CRO Plate 14). The Fruitland 4 and Fruitland 5 coal beds have low development potential in several isolated areas shown on the areal distribution map (CRO Plate 19). Thickness of the coal varies from 5 to 8 ft (1.5-2.4 m) for the Fruitland 4 (CRO Plate 16) to 5 to 9 ft (1.5-2.7 m) for the Fruitland 5 (CRO Plate 20), and the overburden is 2,260 to 2,600 ft (669-792 m) thick for the Fruitland 4 (CRO Plate 18) and 2,400 to 2,800 ft (732-853 m) thick for the Fruitland 5 (CRO Plate 22).

The central and southwestern parts of the quadrangle have unknown development potential and include areas where the individual coal bed thicknesses are less than 5 ft (1.5 m) and areas outside the 3,000-foot (914-m) overburden study limits. A small area with no coal development potential occurs in the extreme southwest corner where there is no Fruitland 1, Fruitland 2, Fruitland 4, or Fruitland 5 coal. Although the Fruitland 3 is present in this area (less than 5 ft [1.5 m] thick, CRO Plate 12), it was necessary to disregard it in order to tie the coal development potential map of Adobe Downs Ranch (CDP Plate 23) to the map for La Plata, the adjoining quadrangle.

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_____, 1950, Map of a portion of San Juan County, New Mexico, and La Plata County, Colorado: U.S. Geol. Survey Oil and Gas Operations Map Roswell 91, revised 1972, 1:31,680.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 1 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

(20)
GL 6489
NR 300 ●
R 2430
C 4 (Fr 3)
R 95
C 5 (Fr 2)
R 2782
TD 5638

DRILL HOLE - Shown solid for oil and gas. Showing drill hole data, in feet. Index number refers to hole on Plate 3 of COO map.

GL - Ground level elevation
NR - No record
R - Rock interval
C - Coal interval
TD - Total depth

TEST HOLE DATA SYMBOLS

Fr zone - Fruitland zone
Fr 5 - Fruitland 5 bed
Fr 4 - Fruitland 4 bed
Fr 3 - Fruitland 3 bed
Fr 2 - Fruitland 2 bed
Fr 1 - Fruitland 1 bed
L - Local bed

COAL BED AND COAL ZONE SYMBOLS AND NAMES

To convert feet to meters, multiply feet by 0.3048.

NR is an average of 300 ft (91 m) of casing. Actual depth of casing not shown.

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24 000

UTM GRID AND 1983 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

MAP SHOWING LOCATION OF THE ADOBE DOWNS RANCH QUADRANGLE (SHADED) AND THE SAN JUAN BASIN KNOWN RECOVERABLE COAL RESOURCE AREA (STIPPLED), NEW MEXICO

This map was prepared under contract to the U.S. Geological Survey and has not been edited for conformity with Geological Survey editorial standards. Opinions and conclusions expressed herein do not necessarily represent those of the Geological Survey.

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

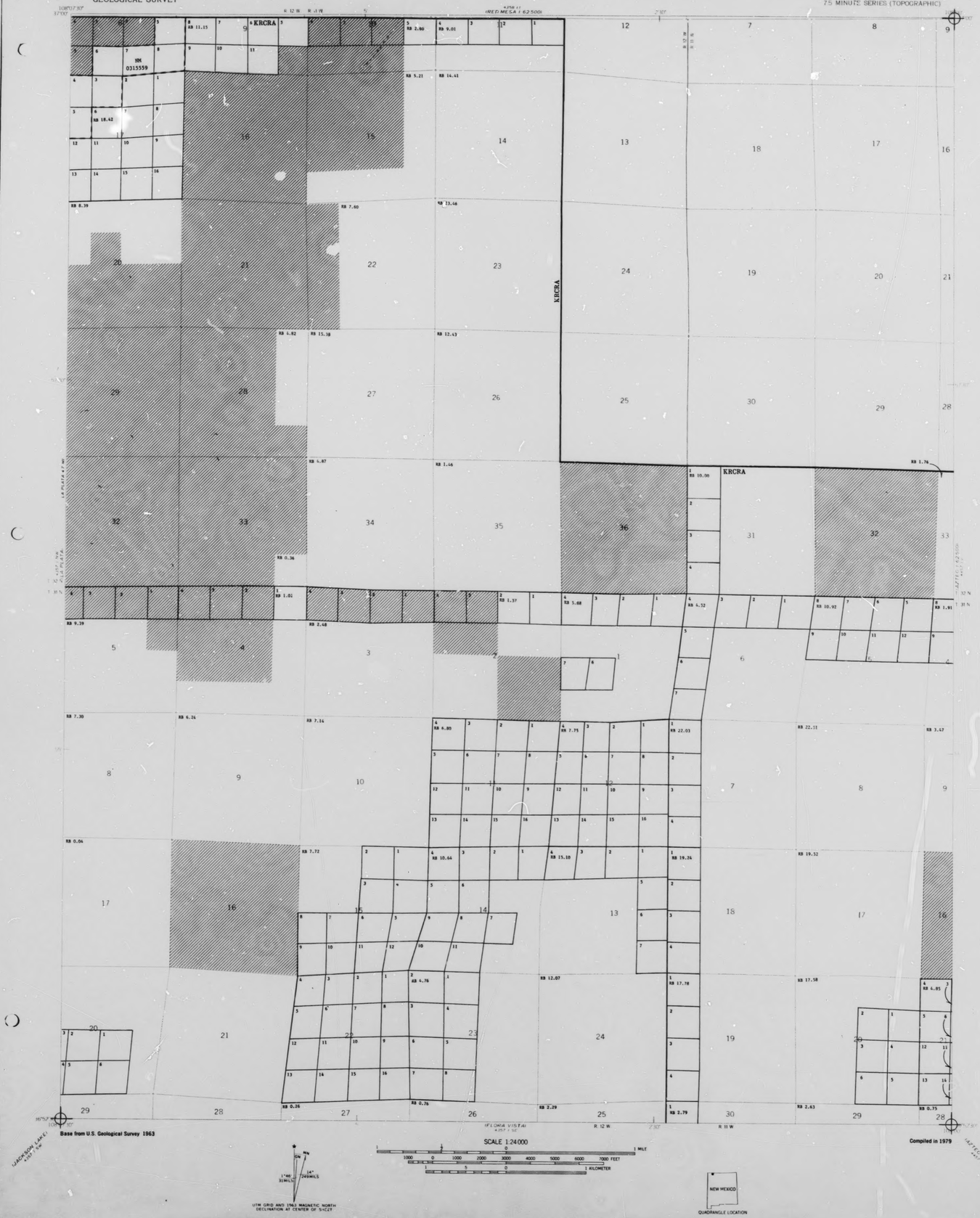
BY
DAMES & MOORE

1979

PLATE 1
COAL DATA MAP

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO–COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)



Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

UTM GRID AND 1965 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

PLATE 2 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

KRCRA

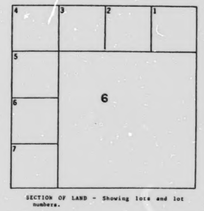
KRCRA BOUNDARY - Label within KRCRA boundary.

NON-FEDERAL COAL LAND - Land within the KRCRA boundary for which the Federal Government does not own the coal rights.

NM 0315559
COAL LEASE - Showing lease number.

RB 13.46

TOTAL RESERVE BASE (RB) OF FEDERAL COAL PER SECTION - In millions of short tons, calculated for each section of Federal land following the guidelines given in U.S. Geological Survey Bulletin 1450-B, p. 7. To convert short tons to metric tons, multiply short tons by 0.9072.



SECTION OF LAND - Showing lots and lot numbers.

NOTE: BLM Coal Ownership Data current as of October 18, 1977.

REFERENCE

U.S. Bureau of Mines and U.S. Geological Survey, 1976, Coal resource classification system of the U.S. Bureau of Mines and U.S. Geological Survey: U.S. Geological Survey Bulletin 1450-B, 7 p.

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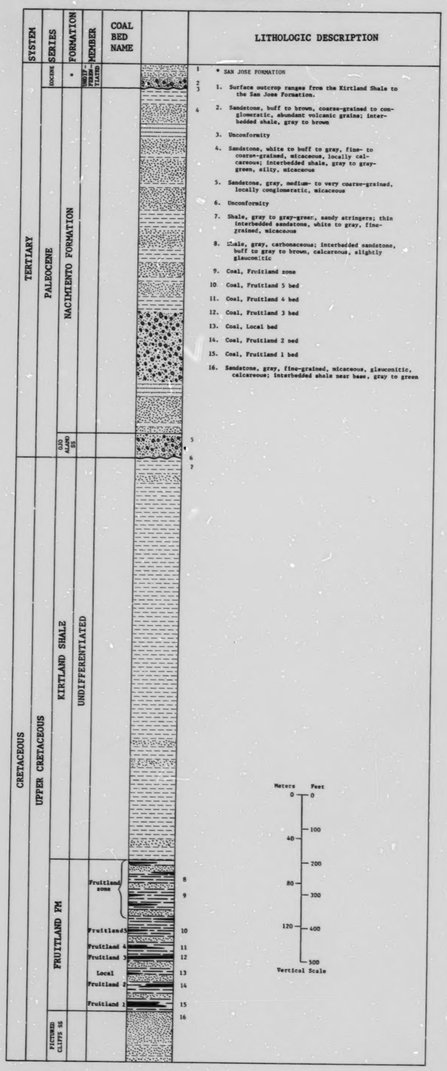
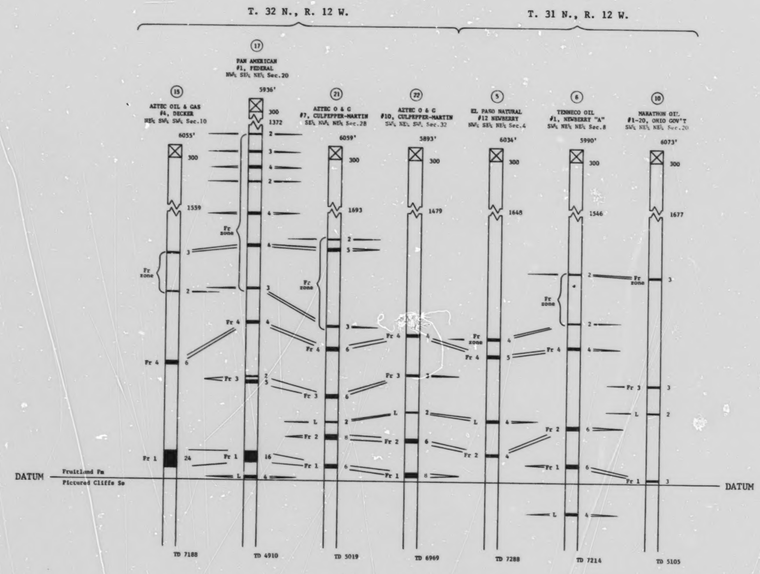
PLATE 2
BOUNDARY AND COAL DATA MAP

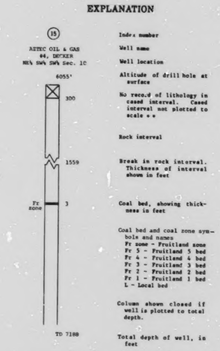
COMPOSITE COLUMNAR SECTION


SYSTEM
SERIES
FORMATION
MEMBER
COAL BED NAME
LITHOLOGIC DESCRIPTION
TERTIARY
PALEOCENE
NACIMIENTO FORMATION
OJO ALAMO
CRETACEOUS
UPPER CRETACEOUS
KIRTLAND SHALE
UNDIFFERENTIATED
FRUITLAND FM
Fruitland zone
Fruitland 5
Fruitland 4
Fruitland 3
Local
Fruitland 2
Fruitland 1
PICTURED CLIFFS SS
* SAN JOSE FORMATION
1. Surface outcrop ranges from the Kirtland Shale to the San Jose Formation.
2. Sandstone, buff to brown, coarse-grained to conglomeratic, abundant volcanic grains; interbedded shale, gray to brown
3. Unconformity
4. Sandstone, white to buff to gray, fine- to coarse-grained, micaceous, locally calcareous; interbedded shale, gray to gray-green, silty, micaceous
5. Sandstone, gray, medium- to very coarse-grained, locally conglomeratic, micaceous
6. Unconformity
7. Shale, gray to gray-green, sandy stringers; thin interbedded sandstone, white to gray, fine-grained, micaceous
8. Shale, gray, carbonaceous; interbedded sandstone, buff to gray to brown, calcareous, slightly glauconitic
9. Coal, Fruitland zone
10. Coal, Fruitland 5 bed
11. Coal, Fruitland 4 bed
12. Coal, Fruitland 3 bed
13. Coal, Local bed
14. Coal, Fruitland 2 bed
15. Coal, Fruitland 1 bed
16. Sandstone, gray, fine-grained, micaceous, glauconitic, calcareous; interbedded shale near base, gray to green
Meters
Feet
Vertical Scale

CORRELATION OF COAL BEDS IN DRILL HOLES


T. 32 N., R. 12 W.
T. 31 N., R. 12 W.
(17) FAN AMERICAN #1, FEDERAL NW¼ SE¼ NE¼ Sec.20 5936'
(15) AZTEC OIL & GAS #4, DECKER NE¼ SW¼ SW¼ Sec.10 6055'
(21) AZTEC O & G #7, GILFFYED-MARTIN SE¼ NW¼ NE¼ Sec.28 6059'
(22) AZTEC O & G #10, GILFFYED-MARTIN SW¼ NE¼ SW¼ Sec.32 5893'
(5) EL PASO NATURAL #12 HUBBERT NW¼ SE¼ NE¼ Sec.4 6036'
(6) TENNECO OIL #1, HUBBERT "A" SW¼ NE¼ NE¼ Sec.8 5990'
(10) MARATHON OIL #1-20, OHIO GOV'T SW¼ NE¼ NE¼ Sec.20 6073'
Fr zone
Fr 4
Fr 3
Fr 2
Fr 1
L
DATUM
Fruitland Fm
Pictured Cliffs Ss
TD 7188
TD 4910
TD 5019
TD 6969
TD 7288
TD 7214
TD 5105

EXPLANATION



Index number

Well name

Well location

Altitude of drill hole at surface

No record of lithology in cased interval. Cased interval not plotted to scale.* *

Rock interval

Break in rock interval. Thickness of interval shown in feet

Coal bed, showing thickness in feet

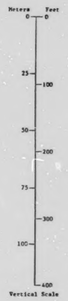
Coal bed and coal zone symbols and names:
Fr zone - Fruitland zone
Fr 5 - Fruitland 5 bed
Fr 4 - Fruitland 4 bed
Fr 3 - Fruitland 3 bed
Fr 2 - Fruitland 2 bed
Fr 1 - Fruitland 1 bed
L - Local bed

Column shown closed if well is plotted to total depth.

Total depth of well, in feet

* Fruitland coals with more than 3,000 ft (914 m) of overburden (the study limit) are not shown.

**An average depth of casing of 300 ft (91 m) was used. Actual depth of casing not shown.



COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY

DAMES & MOORE

1979

Compiled in 1979

PLATE 3
SHEET 1 OF 2
COAL DATA SHEET

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OPEN FILE REPORT 79-1111
PLATE 3 OF 23

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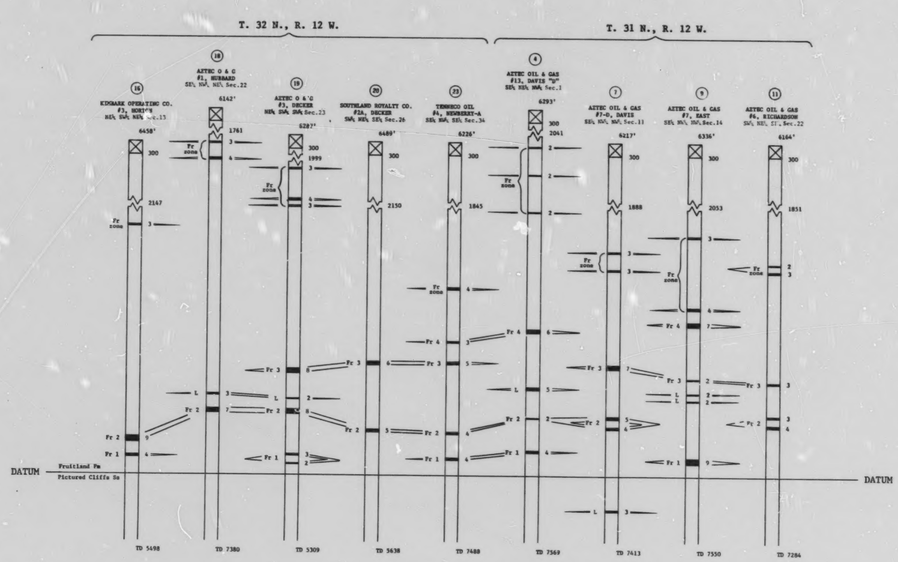
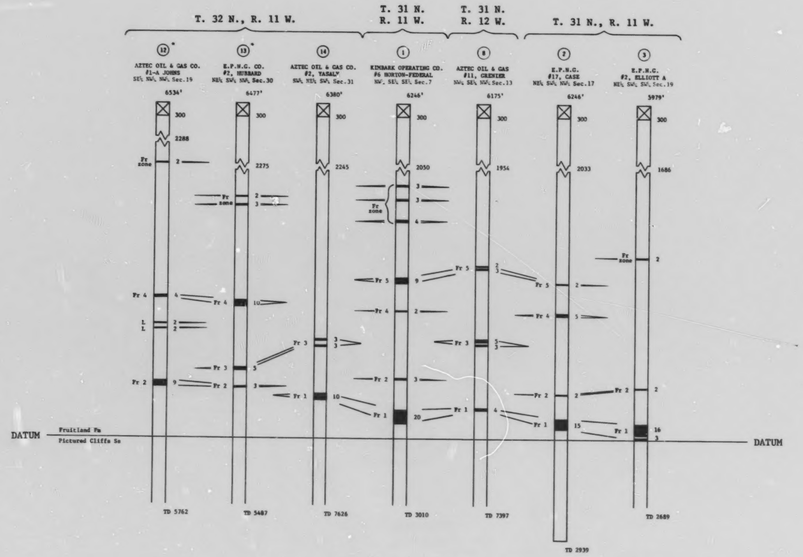
CORRELATION OF COAL BEDS IN DRILL HOLES





COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY

DAMES & MOORE

1979

Compiled in 1979

PLATE 3
SHEET 2 OF 2
COAL DATA SHEET

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OPEN FILE REPORT 79-1111
PLATE 3 OF 23

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO--COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 4 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

0

5

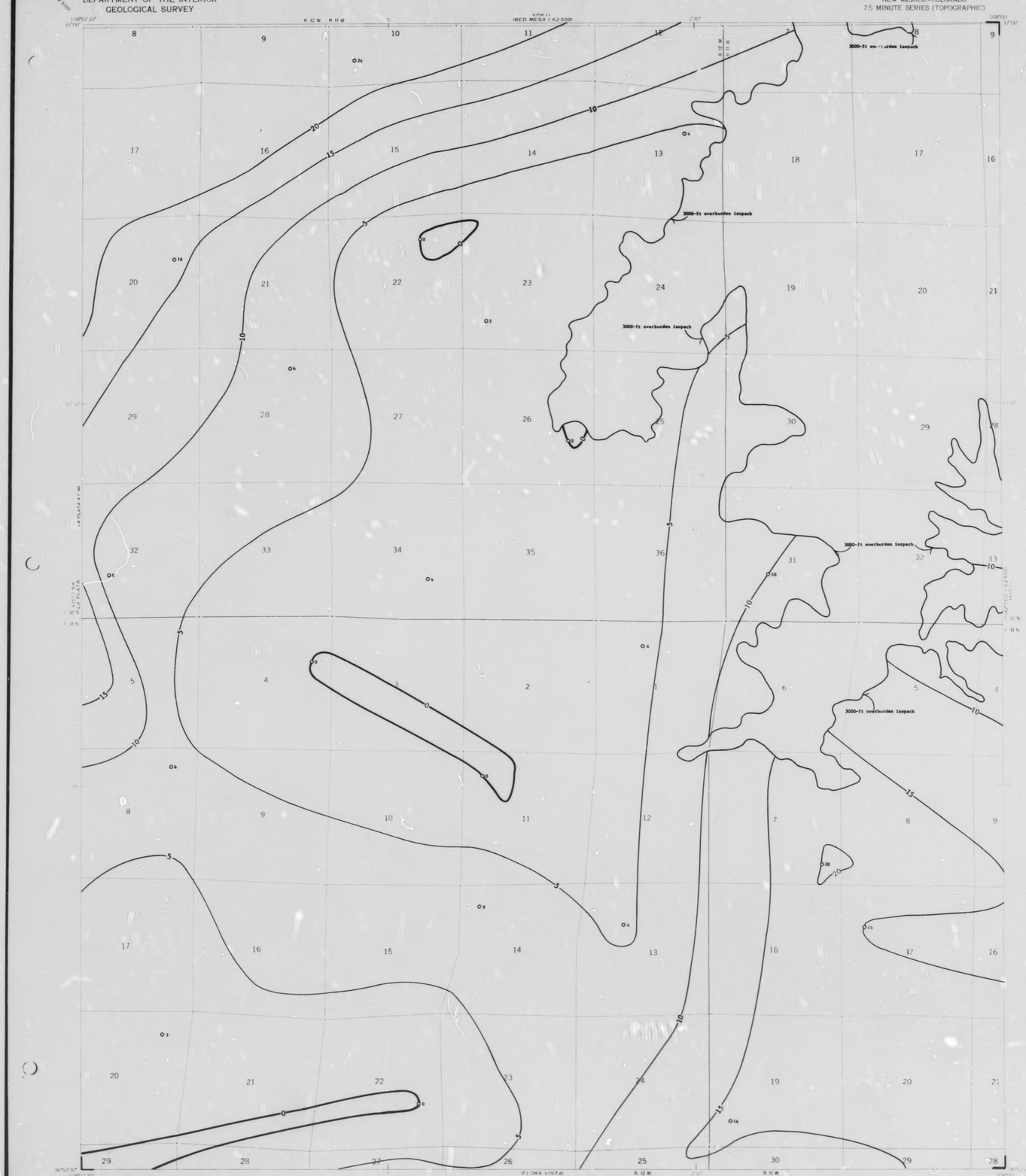
ISOPACHS OF THE FRUITLAND 1 COAL BED - Showing thickness, in feet. Isopach interval 5 feet (1.5 meters).

O10

DRILL HOLE - Showing thickness of the Fruitland 1 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds isopached as a single bed on this map are equivalent in stratigraphic position but may not be continuous.



Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24 000

1 MILE

1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO

QUADRANGLE LOCATION

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY

DAMES & MOORE

1979

PLATE 4

ISOPACH MAP OF THE FRUITLAND 1 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 5 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

3800
4000

STRUCTURE CONTOURS - Drawn on top of the Fruitland 1 coal bed. Contour interval 200 feet (61 meters). Datum is mean sea level. Contours dashed where projected through nonconl-bearing area. Supplemental 3,500-foot (1,067-meter) and 3,700-foot (1,128-meter) structure contours added.

○ 3621

DRILL HOLE - Showing altitude at the top of the Fruitland 1 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds contoured as a single surface on this map are equivalent in stratigraphic position but may not be continuous.

3000-ft overburden isopach

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

PLATE 5
STRUCTURE CONTOUR MAP
OF THE FRUITLAND 1 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

PLATE 6 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

3000

OVERBURDEN ISOPACHS - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland I coal bed. Isopach interval 200 feet (61 meters). Isopachs dashed where projected through noncoal-bearing area.

2948

DRILL HOLE - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland I coal bed.

To convert feet to meters, multiply feet by 0.3048.

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 6
ISOPACH MAP OF OVERBURDEN
OF THE FRUITLAND I COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 7 OF 23

OPEN FILE REPORT 79-1111

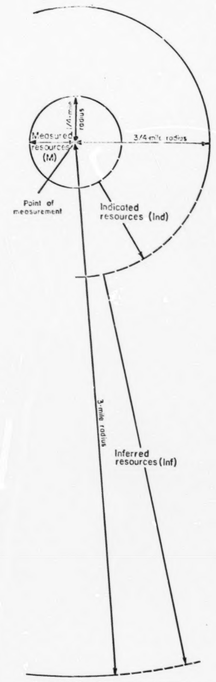
EXPLANATION

NON-FEDERAL COAL LAND - Land within the KRCRA boundary for which the Federal Government does not own the coal rights.

BOUNDARY OF IDENTIFIED RESERVE BASE COAL - Drawn along the 5-foot (1.5-m) coal isopach (I), the KRCRA boundary (K), the Federal coal lease boundary (F), and the 3000-foot (914-m) overburden study limit (S). Arrow points toward area of identified Reserve Base coal.

RB	R(50%)
0.17	0.09 (Measured resources)
0.72	0.36 (Indicated resources)
	(Inferred resources)

IDENTIFIED COAL RESOURCES OF THE FRUITLAND 1 COAL BED - Showing totals for Reserve Base (RB) and Reserves (R), in millions of short tons, for each section or part(s) of section of Federal coal land outside the stripping-limit line. Dash indicates no resources in that category. Reserve Base (RB) x (Pa*Recovery Factor (50 percent) = Reserves (R).



BOUNDARY LINES - Enclosing areas of measured (M), indicated (Ind), and inferred (Inf) coal resources. Dashed where projected from adjacent quadrangles.

To convert short tons to metric tons, multiply short tons by 0.9072.

To convert miles to kilometers, multiply miles by 1.609

Values given for subsurface Reserve (R) tonnages represent 50% of the calculated Reserve Base (RB) values. Calculated Reserve Base and Reserve values have been rounded off to the nearest 10,000 tons of coal.

Reserve Base and Reserve values of 0.00 represent resources of less than 5,000 tons of coal.

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24 000

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 7
AREAL DISTRIBUTION
AND IDENTIFIED RESOURCES OF THE
FRUITLAND 1 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO - COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 8 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

0
5

ISOPACHS OF THE FRUITLAND 2 COAL BED - Showing thickness, in feet. Isopach interval 5 feet (1.5 meters). Isopachs dashed where inferred.

O 2

DRILL HOLE - Showing thickness of the Fruitland 2 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds isopached as a single bed on this map are equivalent in stratigraphic position but may not be continuous.

3000-ft overburden isopach

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24 000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 8
ISOPACH MAP OF THE
FRUITLAND 2 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 9 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

4000

4200

STRUCTURE CONTOURS - Drawn on top of the Fruitland 2 coal bed. Contour interval 200 feet (61 meters). Datum is mean sea level. Concours long dashed where inferred, short dashed where projected through noncoal-bearing area. Supplemental 3,500-foot (1,067-meter) and 3,700-foot (1,128-meter) structure contours added.

○ 3511

DRILL HOLE - Showing altitude at the top of the Fruitland 2 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds contoured on a single surface on this map are equivalent in stratigraphic position but may not be continuous.

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 9
STRUCTURE CONTOUR MAP
OF THE FRUITLAND 2 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 10 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

2000

OVERBURDEN ISOPACHS - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 2 coal bed. Isopach interval 200 feet (61 meters). Isopachs long dashed where inferred, short dashed where projected through noncoal-bearing area.

2730

DRILL HOLE - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 2 coal bed.

To convert feet to meters, multiply feet by 0.3048.

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO

QUADRANGLE LOCATION

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

PLATE 10
ISOPACH MAP OF OVERBURDEN
OF THE FRUITLAND 2 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE II OF 23

OPEN FILE REPORT 79-1111

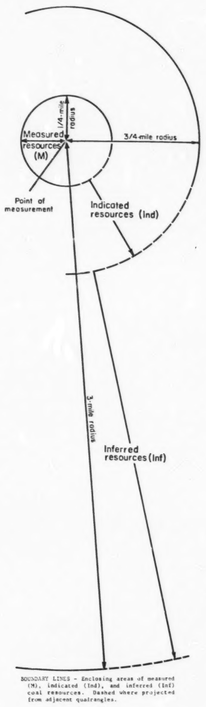
EXPLANATION

NON-FEDERAL COAL LAND - Land within the ERCRA boundary for which the Federal Government does not own the coal rights.

BOUNDARY OF IDENTIFIED RESERVE BASE COAL - Drawn along the 5-foot (1.5-m) coal isopach (1), the ERCRA boundary (2), and the 3000-foot (914-m) overburden study limit (3). Arrow points toward area of identified Reserve Base coal.

RB	R (50%)	
0.38	0.19	(Measured resources)
0.09	0.05	(Indicated resources)
--	--	(Inferred resources)

IDENTIFIED COAL RESOURCES OF THE FRUITLAND 2 COAL BED - Showing totals for Reserve Base (RB) and Reserves (R), in millions of short tons, for each section or part(s) of section of Federal coal land outside the stripping-limit line. Dash indicates no resources in that category. Reserve tons (RB) x the Recovery Factor (50 percent) = Reserves (R).



BOUNDARY LINES - Enclosing areas of measured (M), indicated (Ind), and inferred (Inf) coal resources. Dashed where projected from adjacent quadrangles.

To convert short tons to metric tons, multiply short tons by 0.9072.

To convert miles to kilometers, multiply miles by 1.609

Values given for subsurface Reserve (R) tonnages represent 50% of the calculated Reserve Base (RB) values. Calculated Reserve Base and Reserve values have been rounded off to the nearest 10,000 tons of coal.

Reserve Base and Reserve values of 0.00 represent resources of less than 5,000 tons of coal.

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE II
AREAL DISTRIBUTION
AND IDENTIFIED RESOURCES OF THE
FRUITLAND 2 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 12 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

0
5

ISOPACHS OF THE FRUITLAND 3 COAL BED. Showing thickness, in feet. Isopach interval 5 feet (1.5 meters).

O7

DRILL HOLE - Showing thickness of the Fruitland 3 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds isopached as a single bed on this map are equivalent in stratigraphic position but may not be continuous.

3000-ft overburden isopach

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

PLATE 12
ISOPACH MAP OF THE
FRUITLAND 3 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 13 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

3500
3600

STRUCTURE CONTOURS - Drawn on top of the Fruitland 3 coal bed. Contour interval 200 feet (61 meters). Datum is mean sea level. Contours long dashed where inferred, short dashed where projected through nonoal-bearing area. Supplemental 3,500-foot (1,067-meter), 3,700-foot (1,128-meter), and 3,900-foot (1,189-meter) structure contours added.

3726
DRILL HOLE - Showing altitude at the top of the Fruitland 3 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds contoured on a single surface on this map are equivalent in stratigraphic position but may not be continuous.

Approximate Limit of Fr 3 Coal Bed

3000-ft overburden isopach

3800
3760
3700
3600
3500

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY

DAMES & MOORE

1979

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PLATE 13
STRUCTURE CONTOUR MAP
OF THE FRUITLAND 3 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 14 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

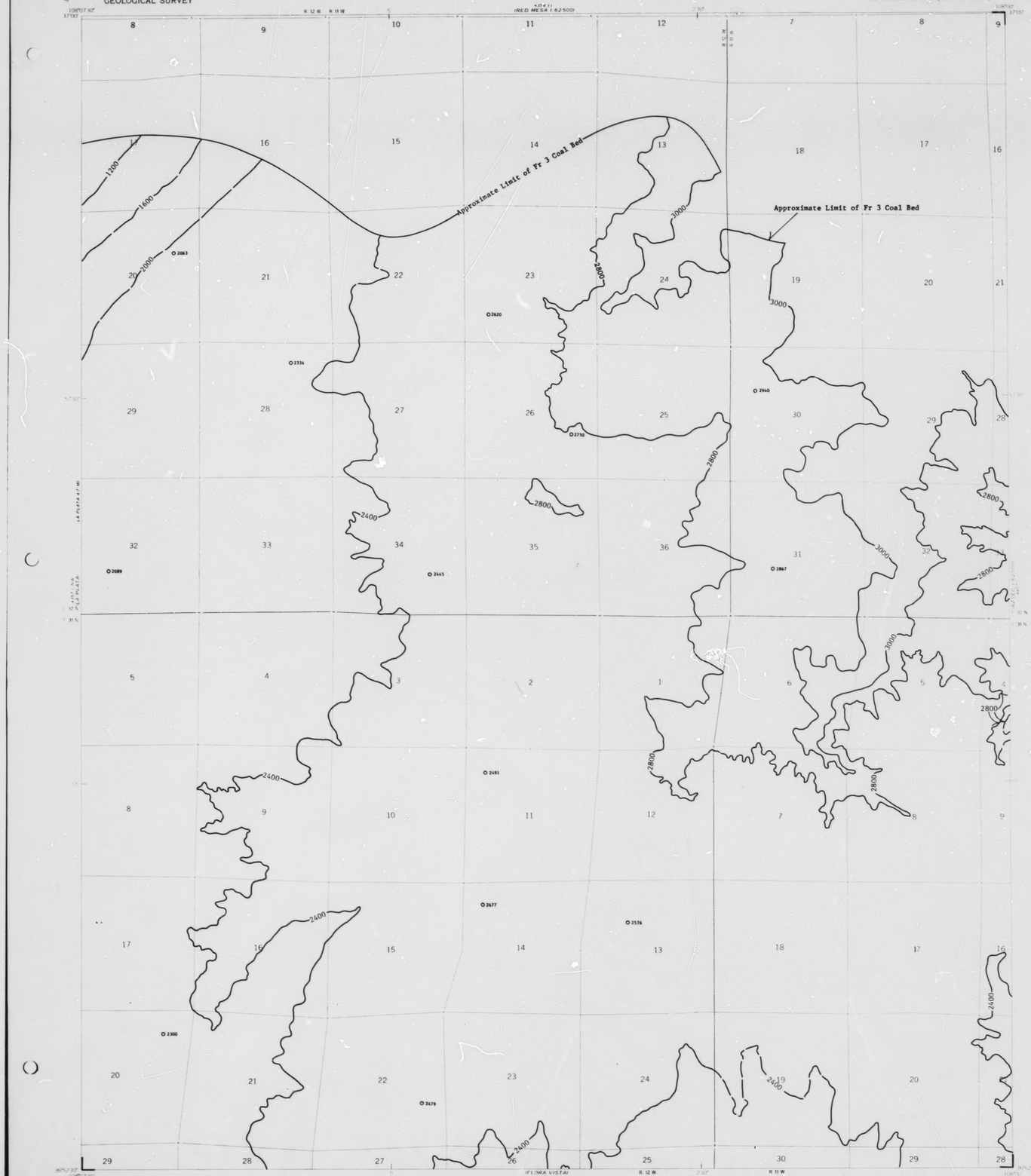
2800

OVERBURDEN ISOPACHS - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 3 coal bed. Isopach interval 400 feet (122 meters). Isopachs long dashed where inferred, short dashed where projected through noncoal-bearing area. Supplemental 3,000-foot (914-meter) overburden isopach added.

O 2491

DRILL HOLE - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 3 coal bed.

To convert feet to meters, multiply feet by 0.3048.



COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 14
ISOPACH MAP OF OVERBURDEN
OF THE FRUITLAND 3 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 15 OF 23

OPEN FILE REPORT 79-1111

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER

GN MN
1°46' 31MILS
14° 266MILS
UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

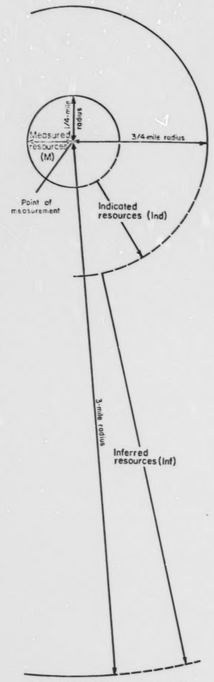
EXPLANATION

NON-FEDERAL COAL (COO) - Land within the ERCRA boundary for which the Federal Government does not own the coal rights.

BOUNDARY OF IDENTIFIED RESERVE BASE COAL - Drawn along the 3-foot (1.5-m) coal isopach (I), the ERCRA boundary (R), and the 3000-foot (914-m) overburden study limit (B). Arrow points toward area of identified Reserve Base coal.

RB R(50I)
-- -- (Measured resources)
0.20 0.10 (Indicated resources)
0.18 0.09 (Inferred resources)

IDENTIFIED COAL RESOURCES OF THE FRUITLAND 3 COAL BED - Showing totals for Reserve Base (RB) and Reserves (R), in millions of short tons, for each section or part(s) of section of Federal coal land outside the stripping-limit line. Dash indicates no resources in that category. Reserve Base (RB) x the Recovery Factor (50 percent) = Reserves (R).



BOUNDARY LINES - Enclosing areas of measured (M), indicated (Ind), and inferred (Inf) coal resources. Dashed where projected from adjacent quadrangles.

To convert short tons to metric tons, multiply short tons by 0.9072.

To convert miles to kilometers, multiply miles by 1.609

Values given for subsurface Reserve (R) tonnages represent 50% of the calculated Reserve Base (RB) values. Calculated Reserve Base and Reserve values have been rounded off to the nearest 10,000 tons of coal.

Reserve Base and Reserve values of 0.00 represent resources of less than 5,000 tons of coal.

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 15
AREAL DISTRIBUTION
AND IDENTIFIED RESOURCES OF THE
FRUITLAND 3 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 16 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

0 ——— 5 ———

ISOPACHS OF THE FRUITLAND 4 COAL BED - Showing thickness, in feet. Isopach interval 5 feet (1.5 meters). Isopachs dashed where inferred.

O7
DRILL HOLE - Showing thickness of the Fruitland 4 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds isopached as a single bed on this map are equivalent in stratigraphic position but may not be continuous.

3000-ft overburden isopach

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1 KILOMETER

NEW MEXICO
QUADRANGLE LOCATION

UTM GRID AND 1983 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY

DAMES & MOORE

1979

PLATE 16

ISOPACH MAP OF THE FRUITLAND 4 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 17 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

4000
4200

STRUCTURE CONTOURS - Drawn on top of the Fruitland 4 coal bed. Contour interval 100 feet (31 meters). Datum is mean sea level. Contours long dashed where inferred, short dashed where projected through noncoal-bearing area. Supplemental 3,700-foot (1,128-meter) and 3,900-foot (1,189-meter) structure contours added.

O 3744

DRILL HOLE - Showing altitude at the top of the Fruitland 4 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds contoured as a single surface on this map are equivalent in stratigraphic position but may not be continuous.

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

PLATE 17
STRUCTURE CONTOUR MAP
OF THE FRUITLAND 4 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO - COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 18 OF 23

EXPLANATION

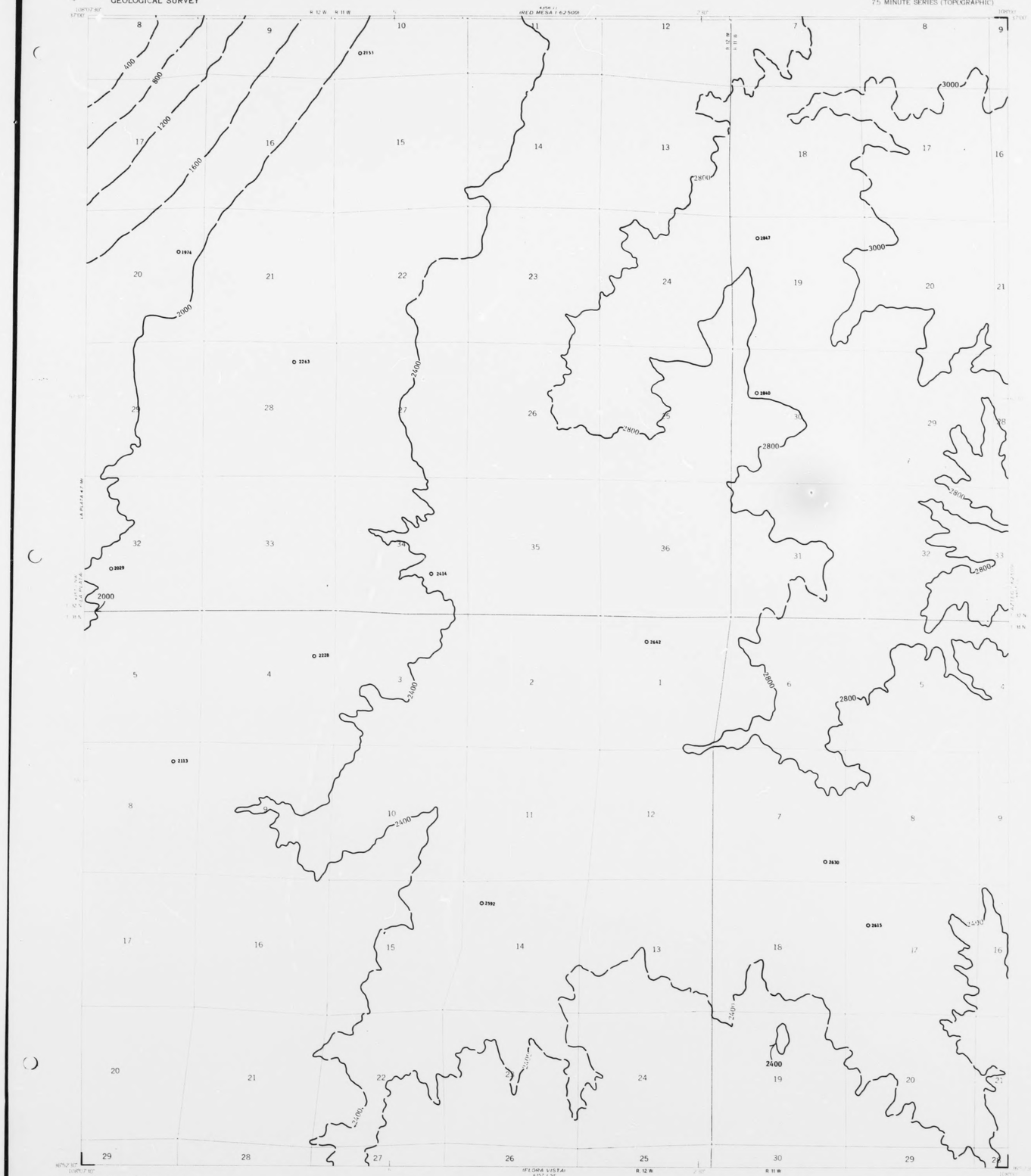
OPEN FILE REPORT 79-1111

2800

OVERBURDEN ISOPACHS - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 4 coal bed. Isopach interval 400 feet (122 meters). Isopachs long dashed where inferred; short dashed where projected through nonCoal-bearing area. Supplemental 3000-foot (914-meter) overburden isopach added.

O 2592
DRILL HOLE - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 4 coal bed.

To convert feet to meters, multiply feet by 0.3048.



Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 18
ISOPACH MAP OF OVERBURDEN
OF THE FRUITLAND 4 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO - COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 19 OF 23
OPEN FILE REPORT 79-1111

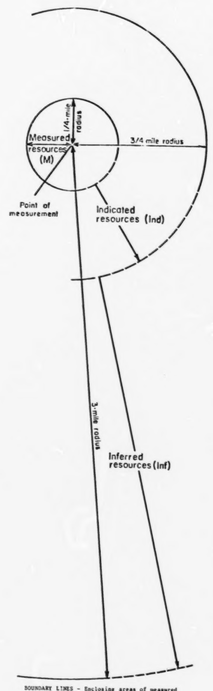
EXPLANATION

NON-FEDERAL COAL LAND - Land within the RSCRA boundary for which the Federal Government does not own the coal rights.

BOUNDARY OF IDENTIFIED RESERVE BASE COAL - Drawn along the 3-foot (1.5-m) coal isopach (I) and the RSCRA boundary (E). Arrow points toward area of identified Reserve Base coal.

RB	R (50%)	
0.50	0.25	(Measured resources)
1.48	0.74	(Indicated resources)
---	---	(Inferred resources)

IDENTIFIED COAL RESOURCES OF THE FRUITLAND 4 OR FRUITLAND 5 COAL BEDS - Showing totals for Reserve Base (RB) and Reserves (R), in millions of short tons, for each section or part(s) of section of Federal coal land outside the stripping-limit line. Dash indicates no resources in that category. Reserve Base (RB) x the Recovery Factor (50 percent) = Reserves (R).



BOUNDARY LINES - Enclosing areas of measured (M), indicated (Ind), and inferred (Inf) coal resources. Dashed where projected from adjacent quadrangles.

To convert short tons to metric tons, multiply short tons by 0.9072.

To convert miles to kilometers, multiply miles by 1.609

Values given for subsurface Reserve (R) tonnages represent 50% of the calculated Reserve Base (RB) values. Calculated Reserve Base and Reserve values have been rounded off to the nearest 10,000 tons of coal.

Reserve Base and Reserve values of 0.00 represent resources of less than 5,000 tons of coal.

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24 000

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 19
AREAL DISTRIBUTION
AND IDENTIFIED RESOURCES OF THE
FRUITLAND 4 AND FRUITLAND 5 COAL BEDS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 20 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

0 ——— 5

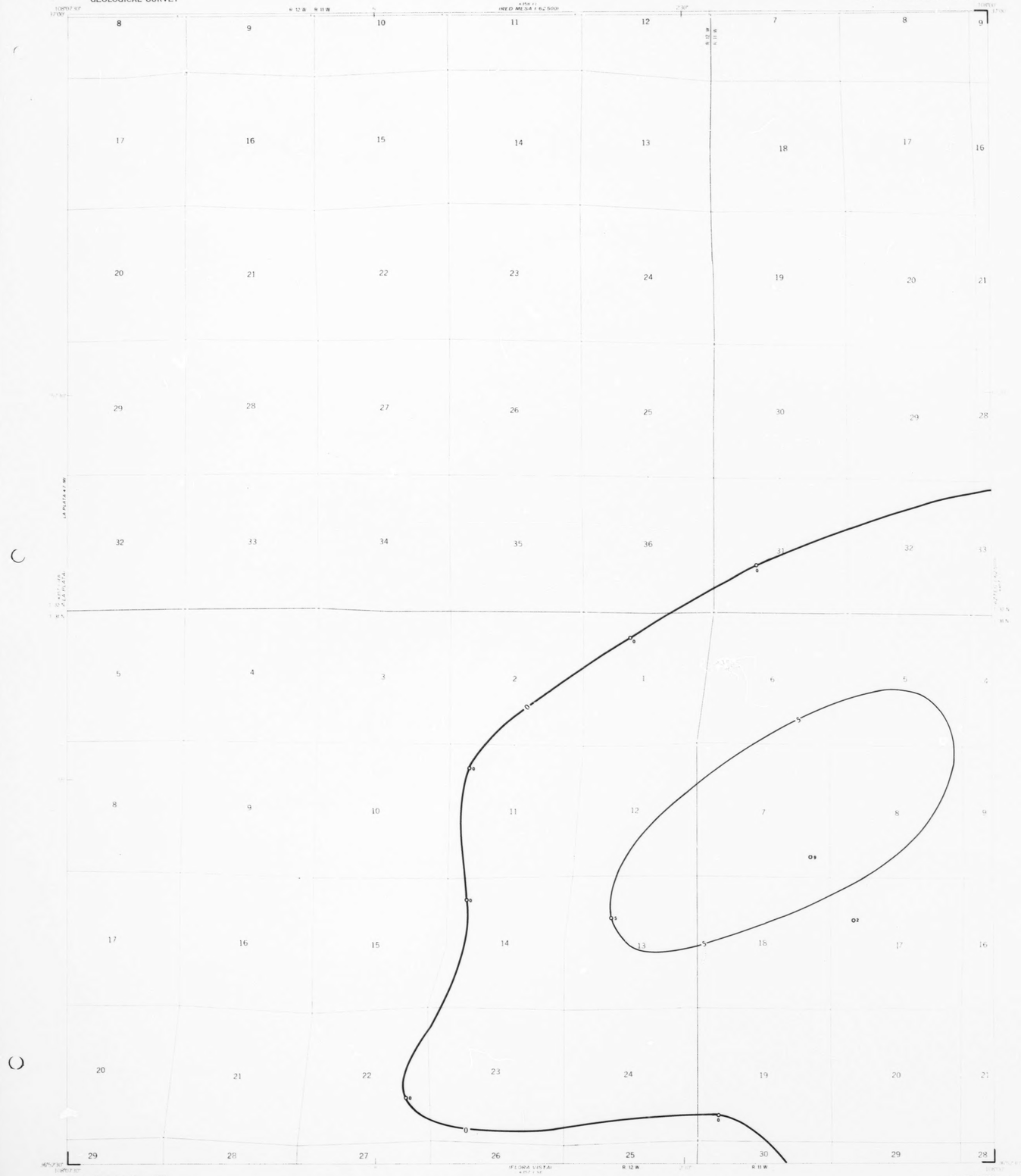
ISOPACHS OF THE FRUITLAND 5 COAL BED Showing thickness, in feet. Isopach interval 5 feet (1.5 meters).

O9

DRILL HOLE - Showing thickness of the Fruitland 5 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds inspected as a single bed on this map are equivalent in stratigraphic position but may not be continuous.



Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE
1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

PLATE 20
ISOPACH MAP OF THE
FRUITLAND 5 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 21 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

3750

3700

STRUCTURE CONTOURS - Drawn on top of the Fruitland 5 coal bed. Contour interval 50 feet (15.2 meters). Datum is mean sea level. Contours dashed where inferred.

O 3708

DRILL HOLE - Showing altitude at the top of the Fruitland 5 coal bed, in feet.

To convert feet to meters, multiply feet by 0.3048.

Fruitland coal beds contoured as a single surface on this map are equivalent in stratigraphic position but may not be continuous.

Approximate Limit of Fr 5 Coal Bed

Approximate Limit of Fr 5 Coal Bed

3600

3650

3700

3750

O 3666

O 3708

O 3676

Base from U.S. Geological Survey 1963

SCALE 1:24000

Compiled in 1979

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO

QUADRANGLE LOCATION

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COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY

DAMES & MOORE

1979

PLATE 21

STRUCTURE CONTOUR MAP
OF THE FRUITLAND 5 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 22 OF 23

EXPLANATION

OPEN FILE REPORT 79-1111

—2600—

OVERBURDEN ISOPACHS - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 5 coal bed. Isopach interval 200 feet (61 meters). Isopachs dashed where inferred.

○ 2580

DRILL HOLE - Showing thickness of overburden, in feet, from the surface to the top of the Fruitland 5 coal bed.

To convert feet to meters, multiply feet by 0.3048.

Approximate Limit of Fr 5 Coal Bed

Approximate Limit of Fr 5 Coal Bed

Base from U.S. Geological Survey 1963

Compiled in 1979

SCALE 1:24000

1 MILE

1 KILOMETER

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

COAL RESOURCE OCCURRENCE MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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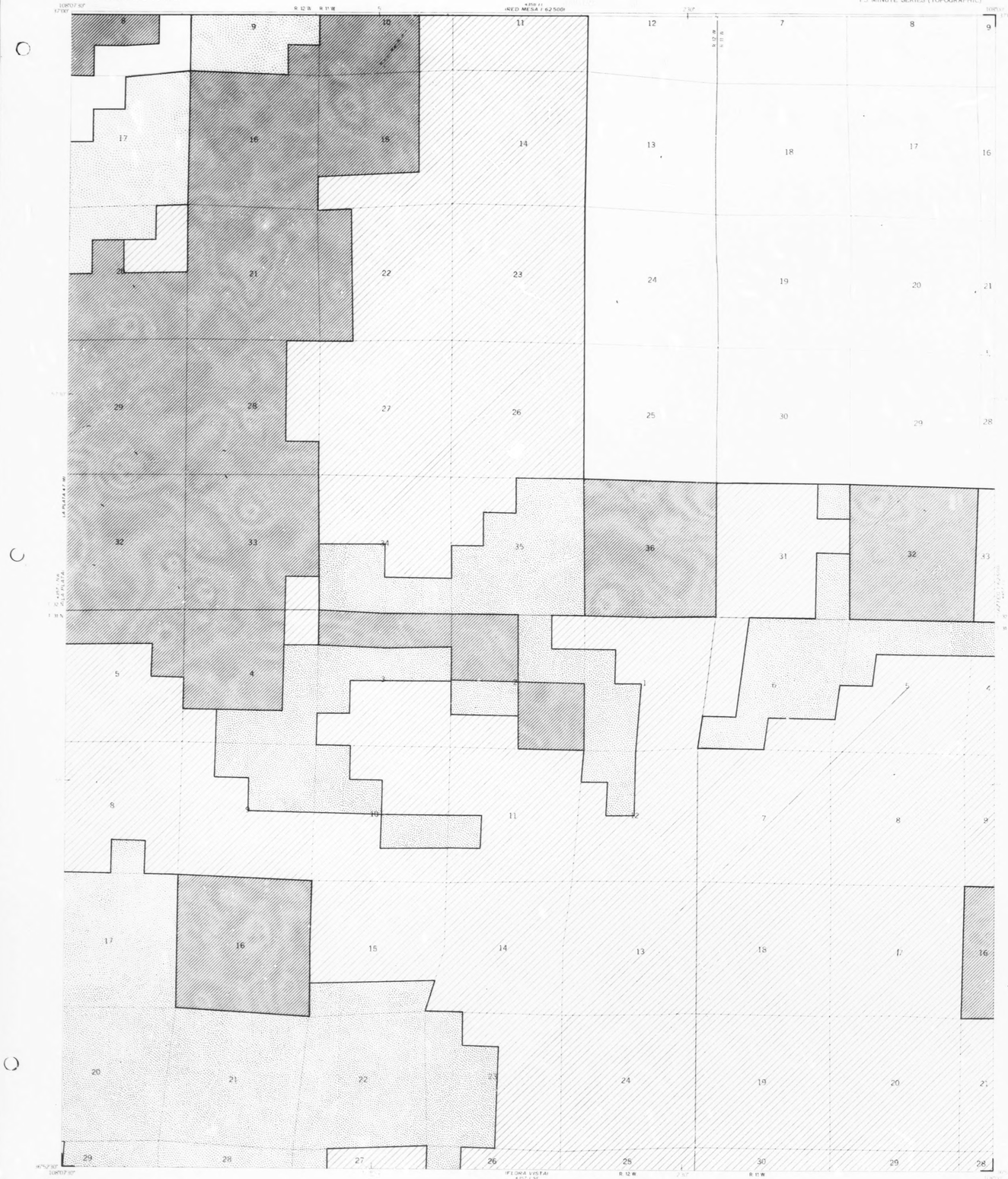
PLATE 22
ISOPACH MAP OF OVERBURDEN
OF THE FRUITLAND 5 COAL BED

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ADOBE DOWNS RANCH QUADRANGLE
NEW MEXICO-COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

PLATE 23 OF 23
OPEN FILE REPORT 79-1111



EXPLANATION

NON-FEDERAL COAL LAND - Land for which the Federal Government does not own the coal rights, and for which the coal development potential is not rated.

AREA OF MODERATE COAL DEVELOPMENT POTENTIAL FOR SUBSURFACE MINING METHODS - Includes areas underlain by coal of the Fruitland 1 and Fruitland 4 beds. Area has overburden thickness ranging from 1000 to 2000 feet (305-610 m).

AREA OF LOW COAL DEVELOPMENT POTENTIAL FOR SUBSURFACE MINING METHODS - Includes areas underlain by coal of the Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, and Fruitland 5 beds. Area has overburden thickness ranging from 2000 to 3000 feet (610-914 m).

AREA OF UNKNOWN COAL DEVELOPMENT POTENTIAL FOR SUBSURFACE MINING METHODS - Includes areas with coal thickness less than 5 feet (1.5 m) and areas outside the 3000-foot (914-m) overburden study limit.

AREA OF NO COAL DEVELOPMENT POTENTIAL FOR SUBSURFACE MINING METHODS - Includes areas with no Fruitland 1, Fruitland 2, Fruitland 4, and Fruitland 5 coal.

Unpatterned areas are Federal coal lease land or outside the BRCRA.

SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

UTM GRID AND 1983 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NEW MEXICO
QUADRANGLE LOCATION

COAL DEVELOPMENT POTENTIAL MAP OF THE ADOBE DOWNS RANCH QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO AND LA PLATA COUNTY, COLORADO

BY
DAMES & MOORE
1979

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PLATE 23
COAL DEVELOPMENT POTENTIAL
FOR SUBSURFACE MINING METHODS